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ABSTRACT

The predictive validity of the Simultaneous Technique for Acuity and Readiness Testing (START), a developmental screening approach, was assessed with school performance as outcome criterion. The sample consisted of over 1,000 rural, preschool children between 54 and 66 months of age who were screened over 3 successive years. Follow-up achievement data were obtained at kindergarten, first, and second grade for Cohort 1, and at first grade only for Cohorts 2 and 3. Special education and retention information were obtained for all children. Participants were classified as having either "poor" or "satisfactory" school outcomes based on both achievement and tracking data. Summary START scores were used to classify the children into low, borderline, and pass categories, which were subsequently cross-classified with the school outcome categories. Findings indicated that among the 75 children in Cohort 1 who scored low on the START, 36 percent had poor school outcomes by kindergarten, 53 percent by first grade, and 59 percent by second grade. Predictive value was substantially lower for Cohorts 2 and 3. Specificity and sensitivity indices were similar across cohorts. Results with stratified samples who were administered standard diagnostic tests suggested that START should serve well as a screening test in pediatric practice. (RH)

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PRESCHOOL PREDICTION OF SCHOOL OUTCOME USING START (SIMULTANEOUS TECHNIQUES FOR ACUITY AND READINESS TESTING)

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The goal of our research group has been to explore ways in which the routine child health examination might become more relevant to issues related to child development. We recognize the practical necessity of keeping any additional pediatric time required to an absolute minimum. To this end we have investigated the possibility that developmental screening could be accomplished by refocusing and reorganizing clinician's attention and effort during the health examination without prolonging the process. Our previous research has shown that a method of simultaneous screening for visual acuity and overall developmental level was both reliable and valid. This method, called START (Simultaneous Technique for Acuity and Readiness Testing), was extremely cost-effective because it was possible to accomplish the developmental screening in the context of routine pediatric vision screening- the entire process takes an average of 8 minutes. We found that it was also cost effective compared to standard vision acuity screening without considering the developmental information primarily due to a reduction in false positives.

In our previous validity studies we have utilized county wide samples and concurrent standard diagnostic developmental testing as criteria. We have replicated our findings and cross validated them using a different criterion test. The present report is an attempt to extend these findings by examining the predictive validity of START with actual school performance as outcome criterion.

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Let me first review the START procedure. Standard preschool vision screening procedures have been modified to make it possible to adjust testing methods as the developmental level of the child becomes evident, and to allow for systematic recording and quantification of behavioral responses. START consists of two phases. In Phase 1, the Test Selection Phase, the child is presented with several vision testing approaches that vary in difficulty (Snellen Letter Naming, Snellen Letter Drawing in the air, Letter matching letter E card matching, letter E hand matching, and picture cards - both Allen and an experimental set). During this phase, the tester rates the child's performance and selects the most suitable vision screening approach, based on an overall judgment as to the most precise (optically correct) method to which the child is able to respond (Snellen Letter Chart is preferred over the Illiterate E Chart, and the least preferable-but sometimes necessary is the Picture Card). In Phase 2, the Test Administration Phase, the tester utilizes the approach selected to screen the child for visual acuity according to our standard protocol.

Data relating to development that were obtained from each child included the correctness of responses to each of the five vision testing approaches presented during Phase 1, as well as ratings of specific behaviors observed during Phase 2. These included ability to follow a 3-part command, and judgment as to overall performance (e.g., persistence).

The study sample consists of preschool children screened over three successive years in a rural county of North Carolina. This county has somewhat higher education and income levels than the state as a whole, and thus more closely approximates national norms. Each year in February or March, children in this county who are to begin kindergarten the following fall are urged to attend a combined health screening and registration program.

In the three cohorts studied, there were over a 1,000 4 1/2 to 5 1/2 year olds with approximately equal numbers of males and females and slightly more whites than non-whites. No one in the school system was made aware of the results of the developmental component of the vision test.

Follow-up achievement data were obtained for kindergarten, first and second grades for Cohort #1 and for first grade only for Cohort #'s two and three. In kindergarten, the CTB/McGraw-Hill Prescriptive Reading Inventory (level one). During grades one and two, the Prescriptive Reading Inventory (Levels two and A) and the Diagnostic Mathematics Inventory (levels A and B) were administered. Scores on these instruments were transformed by CTB/McGraw-Hill to estimate California Achievement Test (CAT) scale and national percentile scores.

Special education and retention information were obtained for all children in the three cohorts. Two approaches were taken. First, an individual who had previously taught in the county's school system was granted access to the records of each school to obtain information on all special education being provided for the children in our three cohorts. All children enrolled in programs for the learning disabled, the educably or trainably mentally handicapped or retarded, the emotionally handicapped and the speech, hearing or other impaired were noted.

Children were then classified as having either "poor" or "satisfactory" school outcomes based on both achievement and tracking data. Children were classified as having poor school outcomes in a given year if they had: scored below the tenth percentile of their cohort on the CAT Reading Scale Score, or been retained in the current or any prior school year, or been staffed into special education classes for the learning disabled, or the educably or trainably mentally handicapped or retarded, (during the same time period).

START scores were calculated for each child by summing the scores for all

items. The summary scores were then used to classify the children into three categories: low--those scoring in the bottom 20% of the cohort or untestable; borderline--those scoring between the 20th and 30th percentiles; and pass--those scoring above the 30th percentile. These groupings were then cross-classified with the school outcome categories described above.

The slide shows these cross-classifications for the kindergarten, first and second grade years of cohort one. Of the 75 children classified as low scorers on START, 36% had poor school outcomes by kindergarten, 53% by first grade, and 59% by second grade. Although far fewer of the children in the borderline category had poor school outcomes, by grade two, 35% had either been retained, staffed into special education or received low CAT scores in one or more grades. Few of those passing START were ultimately identified as having poor school outcomes--5%, 12%, and 15%, respectively, in kindergarten, first and second grades.

Clinical indices predicting school outcome from the START indicate that the sensitivity of START is moderate in all three years, but does decline somewhat from a high of .60 in kindergarten to .48 and .46 in first and second grades, respectively. Specificity remains consistently high across all three years (.86 - .89), while, as described above with the percentages, the predictive value increased from .36 to .59 from kindergarten to second grade. The over- and under-referral rates range from about 5% to 14%. Inclusion of the borderline children in the calculation of the indices would enhance the sensitivity of the test (to greater than .50 in all years), at the expense of a moderate decrement in the predictive value and increment in the over-referral rates.

In cohorts two and three for which school outcome information was available through first grade only, the sensitivity and specificity indices

closely parallel those for cohort one (sensitivities = .53 and .47, respectively; specificity = .86 in both years). However, the predictive value was substantially lower (to .37 and .34) in these cohorts. It should be noted that, during these years, far fewer children (less than half as many) were retained or staffed into learning disabled and mentally handicapped and retarded classes than had been in cohort one, while far greater numbers (more than twice as many) were placed in special speech and language classes. Analyses are ongoing now to determine the exact nature of our hits and misses, to evaluate whether other characteristics of the child might enhance the accuracy of our prediction, and to determine whether there is a relationship between our measures and other special education designations such as speech.

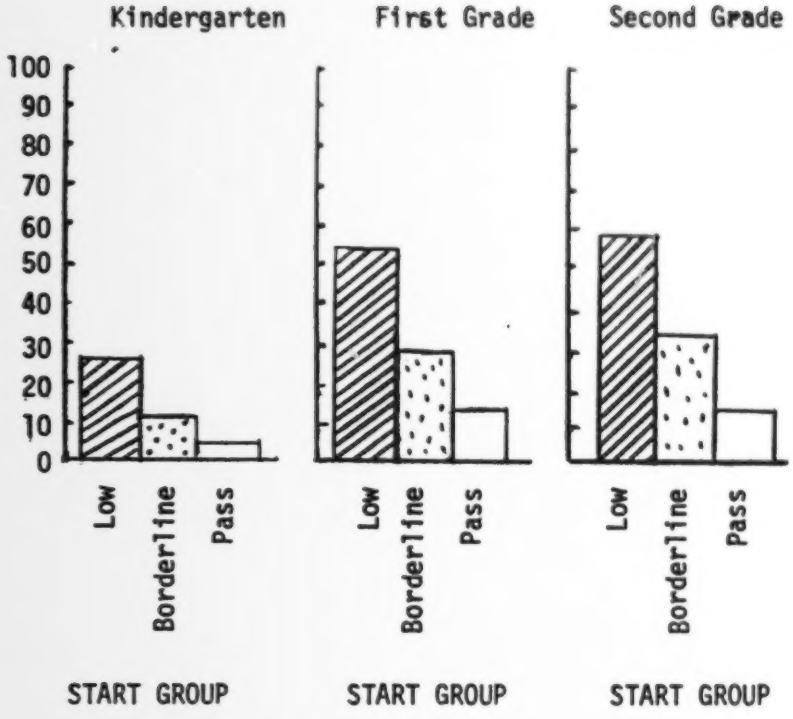
In addition to the studies I have discussed, within each cohort we selected a stratified sample and administered standard diagnostic tests. Parallel analyses were completed using the criterion tests employed in stratified samples in each of the study years. The criterion test results (McCarthy and Stanford Binet) were grouped into low, those scoring 2 standard deviations below the norm mean; intermediate, those scores between 1 and 2 standard deviations below the norm mean; and all others. These results indicated that the START test predicts about as well as the McCarthy and significantly better than the Stanford Binet IQ test. Of course the START cannot replace these tests because it does not provide any diagnostic information, but since these indices show prediction rates as good as or better than the more time consuming, gold standard diagnostic developmental tests START should serve well as a screening test in pediatric practice.

Demographic Characteristics

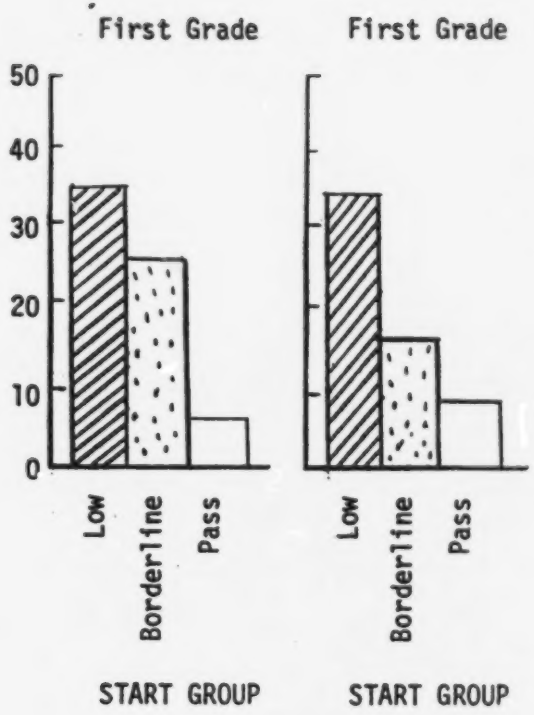
		Cohort 1 N=439	Cohort 2 N=382	Cohort 3 N=352
Age	range	52-64 mo.	52-65 mo.	52-65 mo.
Sex	male	51%	52%	51%
	female	49%	48%	48%
Race	white	54%	59%	64%
	non-white	46%	41%	36%
Head of Household	father	69%	75%	79%
	other	31%	25%	21%
Education of Head of Household	<High School	31%	35%	31%
	≥High School	69%	65%	69%
Income	<5,000	21%	20%	14%
	5,000-9999	38%	35%	25%
	10,000-14,999	21%	26%	26%
	15,000-24,999	18%	16%	29%
	≥25,000	2%	3%	6%

COHORT 1

	Kindergarten	First Grade	Second Grade
Sensitivity	.60	.48	.46
Specificity	.86	.88	.89
Predictive Value	.36	.53	.59
Overreferred	12.3%	9.3%	8.3%
Underreferred	4.7%	11.4%	14.0%


Kindergarten
First Grade
Second Grade
100
90
80
70
60
50
40
30
20
10
0
Low
Borderline
Pass
START GROUP

	COHORT 2 First Grade	COHORT 3 First Grade
Sensitivity	.53	.47
Specificity	.86	.86
Predictive Value	.37	.34
Overreferred	12.0%	12.2%
Underreferred	6.3%	7.4%


First Grade
First Grade
50
40
30
20
10
0
Low
Borderline
Pass
Low
Borderline
Pass
START GROUP
START GROUP

First Grade

	McCarthy	START
Sensitivity	.51	.47
Specificity	.89	.86
Predictive Value	.65	.34
Overreferral	7.96%	12.2%
Underrefferal	14.33%	7.4%

First Grade

	Stanford Binet	START
Sensitivity	.44	.53
Specificity	.83	.86
Predictive Value	.48	.37
Overreferral	12.7%	12.0%
Underreferral	14.7%	6.3%

END

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